

PRESS RELEASE

March 26, 2013

OPERA observed a third neutrino tau

The OPERA international experiment at the INFN Gran Sasso Laboratory (Italy) has observed a third neutrino “flavour” oscillation. The “muon-type” neutrino produced at CERN in Geneva arrived at the Gran Sasso laboratory as a “tau” neutrino. An extremely rare event observed only twice before, in 2010 and in 2012. The OPERA international experiment (involving 140 physicists from 28 research institutes in 11 countries) was set up for the specific purpose of discovering this exceptionally rare event. Its observation explains something scientists have been trying to understand for more than 40 years: the fact that far fewer neutrinos seem to arrive from the sun and other stars than expected. These “missing neutrinos” are in actual fact those that have oscillated into a different flavour.

The OPERA experiment was set up in 2001 for this specific purpose. A beam of neutrinos produced at CERN in Geneva travels towards the underground laboratory at the INFN Gran Sasso facility. Thanks to their extremely rare interactions with matter, after travelling through the earth for some 730 km the neutrinos arrive unperturbed at the giant OPERA detector (more than 4,000 tonnes, a volume of approx. 2,000 m³ and nine million photographic plates) where the minute quantity of particles that are caught are observed. In nature there are three kinds of neutrinos, termed “flavours”: electron, muon and tau. OPERA looks for the tau neutrinos knowing that all those leaving CERN are muon neutrinos. When neutrinos of another “flavour” are detected this is proof that oscillation occurs during the 730 km journey. After the first neutrinos arrived at the Gran Sasso laboratory in 2006, the experiment gathered data for five consecutive years, from 2008 to 2012. The first tau neutrino was observed in 2010, the second in 2012.

According to the head of the international research team, Giovanni De Lellis, from the Federico II University and INFN in Naples, the arrival of the third tau neutrino “is an important confirmation of the two previous observations. This event has certain characteristics that make it entirely different from other processes. Statistically speaking too, the observation of three tau neutrinos provides the evidence of oscillations in the muon to tau neutrino channel in appearance mode. The data analysis will be pursued for two more years searching for other tau neutrinos that could definitely prove this very rare phenomenon.

INFN press office

Eleonora Cossi - +39 06 6868162

Eleonora.cossi@presid.infn.it

LNGS external relations

Roberta Antolini – +39 0862 24372165

Roberta.antolini@lngs.infn.it